

May 4, 1954

O. E. ROSAEN
VANE PUMP

2,677,330

Filed March 15, 1950

3 Sheets-Sheet 1

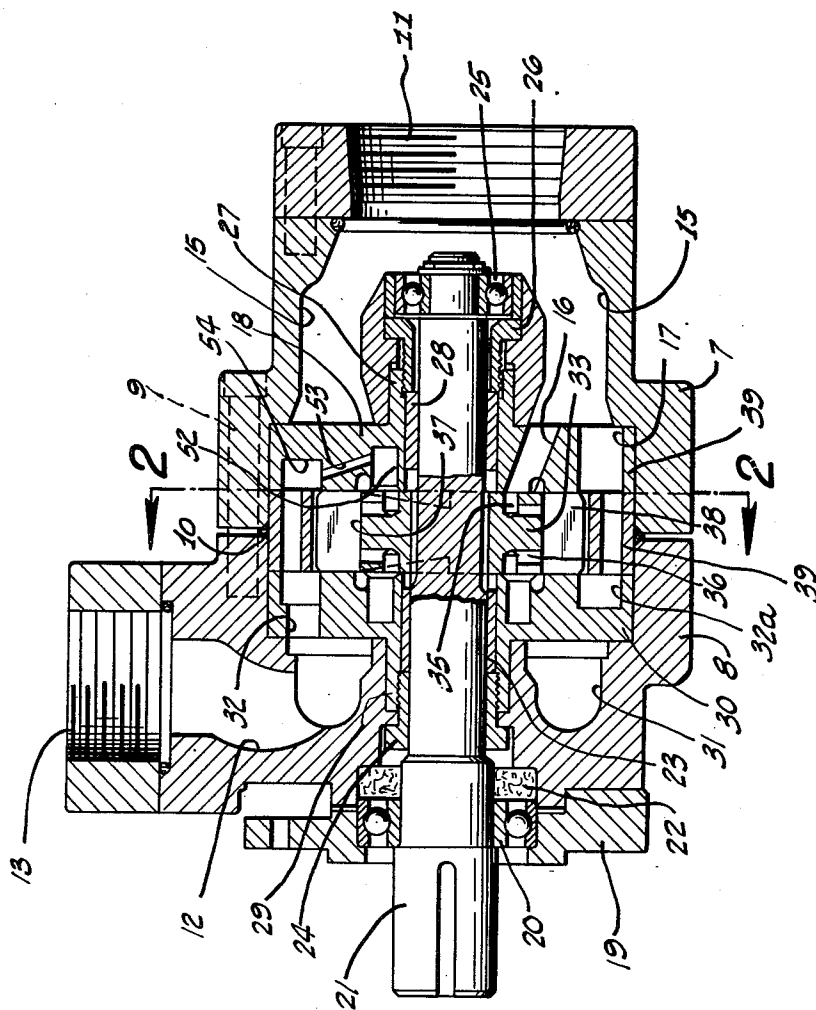


FIG. 1.

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FIG. 2.

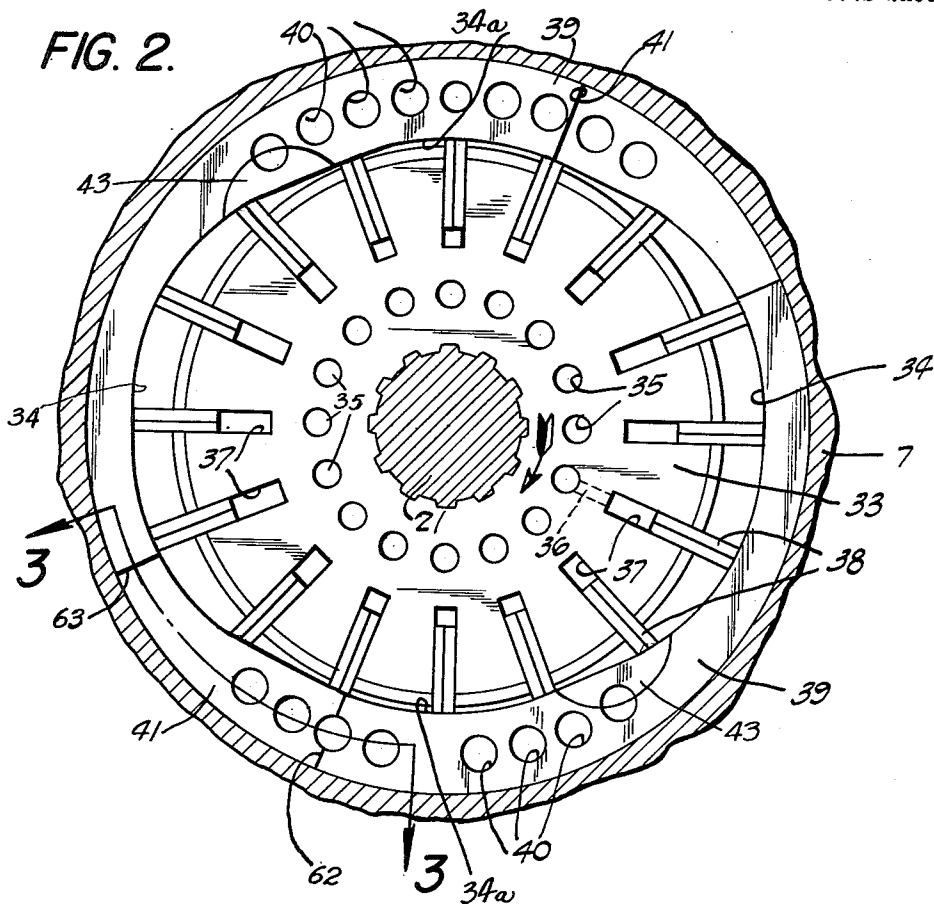
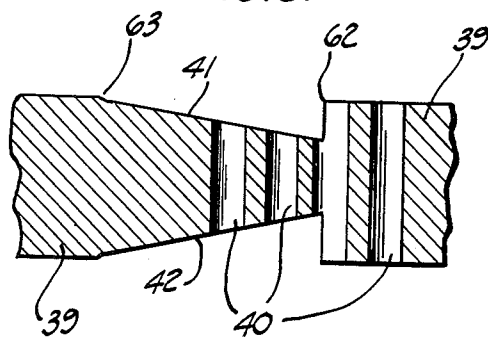


FIG. 3.



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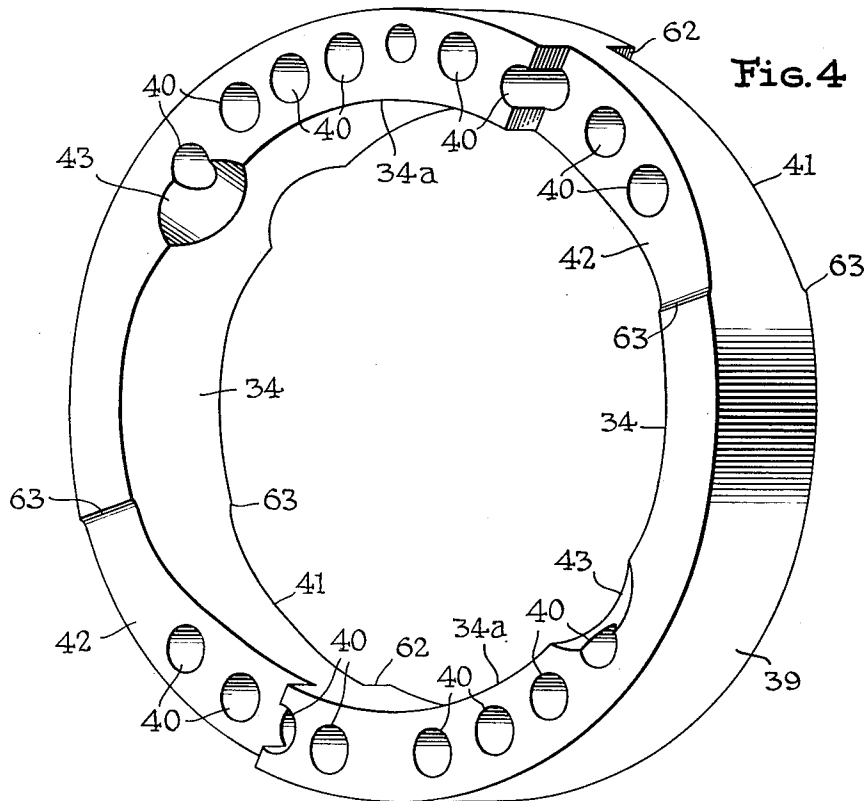


Fig. 4

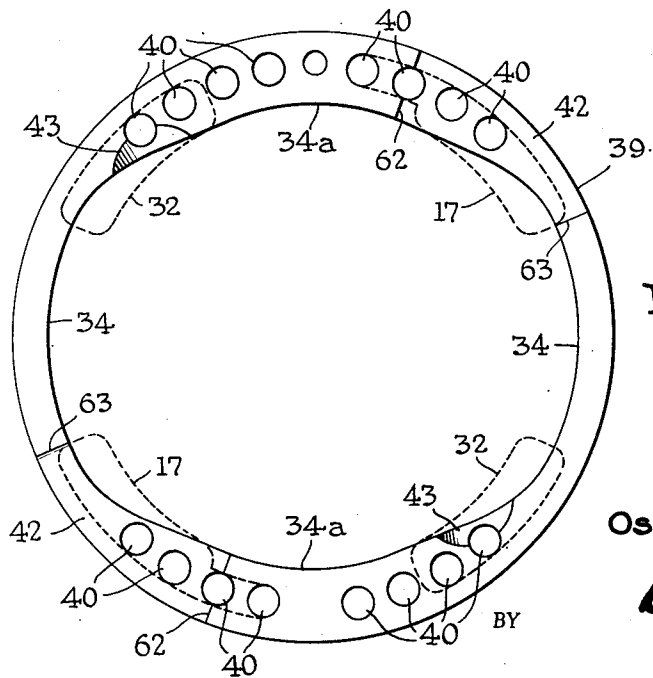


Fig. 5

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UNITED STATES PATENT OFFICE

2,677,330

VANE PUMP

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5 Claims. (Cl. 103—136)

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My invention relates to a new and useful improvement in a rotary vane pump adapted for use in pumping liquid. In this description the invention is referred as being applied to a pump of this type but it will also appear obvious that it could be used equally well with a fluid operated motor. Indeed substantially the same structure might be used for a pump or a motor.

In liquid pumps of this type a rotor is usually provided with radially movable vanes which are adapted to contact the inner surface of the ring in which the rotor is positioned, this inner surface of the ring having portions of two different diameters connected by transition inclines at respective ones of which the inlet and discharge ports are located. Experience has shown that with pumps of this type the vanes are subjected to an uneven pressure on opposite sides caused by slow flow of liquid into and out of the interval between the rotor and the ring, and resulting in a slight tilting or cocking sufficient to effect a cramping or binding of the vane in the slot in which it slides. This impairs the efficiency of the device and causes erratic vane action and attendant damage to the vanes. This pressure on the vane is first effective when the vane picks up a quantity of liquid at the inlet side of the ring and begins to push the liquid ahead of it. As the rotor rotates and the vane leaves the inlet port there is a suction or vacuum set up behind the vane which remains until the vane or blade leaves the outlet port and completes its cycle of operation. These vanes are forced radially outwardly either by a spring or by liquid under pressure and due to the binding referred to this outward pressure of the spring or liquid on the blade is resisted with the result that the blade does not follow at its outer edge the inner surface of the ring but may travel for some distance in spaced relation thereto. When this blade finally moves outward, it moves rapidly so as to strike a blow against the inner surface of the ring.

Experience has also shown that the intervane spaces when passing the intake port do not receive their full volume of liquid and it is an object of the present invention to avoid this difficulty and to provide a structure in which the full charge of liquid may be delivered to these spaces.

It is another object of the invention to provide a structure in which throughout the transition zones, in which the vanes move in or out, there will be maintained at opposite sides of these vanes a substantial balance so as to avoid the tilting or binding effect referred to.

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Other objects will appear hereinafter.

It is recognized that various modifications and changes may be made in the detail of structure illustrated without departing from the invention and it is intended that the present disclosure shall be considered as illustrative of the inventive principle.

In the drawings:

Fig. 1 is an axial sectional view of a pump or motor embodying the invention, the plane of section being diametric as to the housing and rotor. As to each of the two cheek plates the portion of the section below the axis is on a radial plane through the inlet ports, and that above the axis is on a radial plane through the discharge ports, these two radial planes thus being at approximately 90° to each other,

Fig. 2 is a fragmentary sectional view taken on line 2—2 of Fig. 1, slightly enlarged,

Fig. 3 is a fragmentary sectional view taken on line 3—3 of Fig. 2,

Fig. 4 is a perspective view of the track ring removed from the housing,

Fig. 5 is a side elevation of the track ring showing in dotted outline the location of the inlet and discharge ports in the cheek plates. Other ports in the cheek plates, notably vane-loading ports are omitted.

As shown in the drawings the pump or motor embodies a housing consisting of the sections 7 and 8 held together by the screws 9 and provided with the sealing ring 10. An inlet 11 is provided at one end of the section 7. The section 8 is provided with the outlet connection 13 connected by passage 12 with the annular channel 31. This channel communicates with the discharge ports 32 which lead through plate 30. There are two ports 32, and they are diametrically opposed but because of the way plate 30 is sectioned in Fig. 1 only one port is visible in that figure.

The inlet 11 communicates by way of passage 15 with the inlet port 17 and the vane loading passage 16 which leads through plate 18. There are two inlet ports diametrically opposed and two related loading passages, but, as plate 18 is sectioned, only one of each is visible in Fig. 1.

19 having a bearing 20 mounted therein in which is journaled one end of the shaft 21. If the structure is to be used as a pump the shaft 21 would be driven by a suitable source of power. On the other hand if the structure is to be used as a motor the shaft 21 would be adapted to whatever is desired to be driven and the shaft 21 would be rotated by liquid under pressure deliv-

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ered into the housing. Around the shaft 21 is mounted suitable packing 22. This shaft 21 extends through a bushing 23 which is mounted in the outlet side-plate 30, this plate 30 having a threaded neck 29 for receiving the nut 24. The opposite end of the shaft 21 is journaled in a bearing 25 which is supported in the nut 26 threaded into the neck 27 extending outwardly from the plate 18. This shaft 21 also passes through the bushing 28.

Opposite each inlet port 17 in plate 18 there is formed a recess 32a just as there is in plate 18 opposite discharge port 32 a recess 54. This reflects the fact, common in the applicant's practice that the two port plates (cheek plates) are mirror duplicates in the sense that the inlet plate 18 has through ports which are mirrored by recesses in the opposed face of the discharge plate 30 and the discharge plate 30 has through ports which are mirrored by recesses in the opposed face of the inlet plate 18. The through ports in one plate are connected with the mirror recesses in the other plate by way of holes 40 drilled for that purpose through ring 39, now about to be described. As typical of applicant's practice in this regard reference is made to his Patent 2,636,481 issued April 28, 1953, on an application filed May 28, 1949. This is one of the applications originally alluded to in the present application.

Positioned in the housing is a ring 39 having its inner surface formed as best shown in Fig. 2 and provided at diametrically opposite sides with an inner surface 34a struck on an arc whose radius slightly exceeds that of the rotor 33 which is positioned in the ring. Positioned between the surfaces 34a and at diametrically opposite sides from each other are the surfaces 34 which are struck on an arc with a larger radius than the radius of the rotor so that a working-space is thus provided between the inner surface of the ring and the periphery of the rotor. Formed in the opposite faces of the rotor 33 are the spaced apart pockets 35 each of which communicates through the bottom of a corresponding passage 36 with a radial slot 37 extended inwardly from the periphery of the rotor 33. Positioned in each of these slots 37 so as to be movable radially inwardly and outwardly is a vane 38.

The construction is such that the liquid entering through the passage 15 will be delivered to one face of the ring 39 and a portion of this liquid permitted to pass through the passage 40 to the opposite face of the ring 39. This liquid will also pass into the chamber 52 through the passage 53 into the space 54 so that the liquid will be delivered to the periphery of the rotor so that it may flow into the space between the rotor and the ring 39. In order that a proper amount of liquid may have access to the rotor and be engaged between the vanes thereof, at the point where the surface 34a meets the surface 34 I have cut away the ring 39 to provide the opposite sides with inclined faces 41 and 42. With this construction therefore when the rotor blade leaves the face 34a and passes onto the incline leading to the face 34 the vane will ride off of the full width of the ring 39 onto the narrowed portion having the opposite faces 41 and 42 inclined. This affords a larger port area for liquid to flow into contact with the periphery of the rotor so that the vanes will carry, as they pass toward the surface 34, a full volume of liquid to the capacity of the rotor. As the blade leaves the point 62

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on the ring 39 and travels to the left of Fig. 3 liquid will flow in back of the vane or blade equalizing the pressures on opposite sides of the vane and prevent cramping of this vane in its slot. Likewise when the vane finally passes the cut away portion and leaves the point 63 the pressures on both sides of the vane will be substantially equalized because the space at the back side of the vane has also been filled with liquid. In this manner the vanes remain substantially perfectly balanced and the disadvantages enumerated relative to the operation and functioning of the vanes are avoided while at the same time the pump will be working at its maximum capacity.

The recesses 43 are formed in opposite faces of ring 39 and are connected by one of the ports 40. They function as discharge passages and discharge through registering recesses in discharge-plate 30.

What I claim is:

1. A hydraulic pump of the vane type comprising in combination, a cylindrical rotor having spaced, generally radial vane slots; vanes in said slots; means biasing said vanes outward; enclosing structure having inlet and discharge connections and comprising a track ring having a rotor-encircling vane-track surface to be engaged by the outer edges of the vanes, and side plates which embrace the sides of the rotor, the side edges of the vanes, and the sides of the track ring, said structure defining diametrically opposite arcuate pumping zones in which the radial distance between track and rotor is substantial, diametrically opposite arcuate idle zones in which the radial distance between the track and rotor is smaller, and interposed transition inclines connecting said arcuate zones; and means affording inlet and discharge ports communicating respectively with said inlet and discharge connections, located at said transition inclines and subtending a radial distance from the periphery of the rotor outward beyond the arcs of respective pumping zones, said ports comprising a through port and an opposed cavity respectively located in opposite side plates and port enlarging recesses formed in opposite side faces of the track ring, opening into the track surface, and communicating with each other and with a corresponding through-port or cavity as the case may be, said recesses affording enlarged flow paths to and from intervane spaces.

2. The combination defined in claim 1 in which certain of the port enlarging recesses formed in the track are approximately co-extensive with the transition incline.

3. The combination defined in claim 1 in which certain of the port enlarging recesses formed in the track extend approximately two intervane intervals.

4. The combination defined in claim 1 in which the two adjacent port enlarging recesses communicate by a passage formed through the body of the track ring.

5. The combination defined in claim 1 in which the outlines of the port-enlarging recesses on the track surface are generally triangular, one side of said outline coinciding with the face of the proximate side plate and substantially the remainder of the outline being oblique to the line of travel of the vane tips as they pass over the recess.

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